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ROYAL AIRCRAFT ESTABLISHMENT

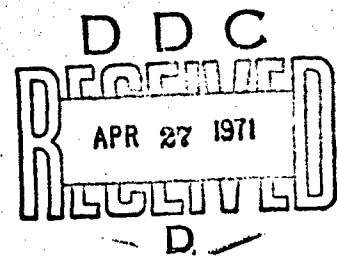
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## DEFENCE RESEARCH ABSTRACTS

UNCLASSIFIED ISSUE 69/70-4

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ROYAL AIRCRAFT ESTABLISHMENT

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February 1971

SWEDISH DEFENCE RESEARCH ABSTRACTS. ISSUE 69/70-4  
(FRÖ FÖRSVAR'S FORSKNINGS REFERAT ÖPPEN DEL 69/70-4)

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EDITOR'S SUMMARY

The Swedish Research Institute for National Defence issues a quarterly list of unclassified reports published by the Institute. The titles of these reports and informative abstracts have been translated into English. This volume covers the fourth quarter of 1970. Further volumes will be translated in due course. The main topics covered are Studies (Systems Analysis), Nuclear Reactions, Chemical and Biological Warfare, Conventional Warfare, Applied Physics, Teletechniques, Biotechnology, Other Investigations, Military Psychology, Psychological Defence.

INDEX TO FRÖ 69/70-41 STUDIES10 Planning of scientific study

- (271) Report on a business visit to Philips, Eindhoven, October 1969
- (272) Cooperation between FOA and FMV sections
- (273) Dial - LIB - program for data treatment in a reference library

11 Methods of study

- (274) Studies on mercury metabolism in mice. FORTRAN program for evaluation of whole body measurement data
- (275) Formation of plans for the future - an introductory discussion
- (276) Data handling - word list. (Defence Classification Centre, FKC)

12 Forecasts

- (277) SYMTPROG and INCARD. A general input system for FORTRAN IV

13 General study activities

- (278) Studies in planning medical attention 3. Application of ISMARC
- (279) Methods for explicit calculation of first and second order moments in an ordered sample of a normally-distributed variable

2 NUCLEAR REACTIONS20 Nuclear reactions - general

- (280) Radioactive means of warfare and initiation by lasers of fusion charges
- (281) Methods, with results and calculations of the variation in effectiveness, in respect of the effect of nuclear warheads on point, extended and composite targets

22 Nuclear physics and reactor physics

- (282) Nuclear physics. Conferences and study visit 1969
- (283) Data centres, who wants what and why? A contribution to an IAEA Panel on neutron data compilation held in Brookhaven February 1969

23 Physical investigations (nuclear)

- (284) Contributions to the physics of high energy density
- (285) Some high pressure energy properties of uranium and other actinides

24 Chemical and metallurgical (nuclear)

- (286) Determination of gallium in gallium plutonium alloys. 1 Determination of macro quantities (1 to 10%) gallium by means of EDTA-titration
- (287) Spectrochemical analysis of trace elements in rock specimens
- (288) Method for measuring rotation speeds and applications in machining
- (289) Experimental technique in the performance of trace element analysers

26 Mechanical and thermal effects of nuclear explosions

- (290) Under water detonations in the Baltic Sea and Skagerak in 1969 for seismological measurements
- (291) Data on air shock waves from nuclear explosions
- (292) Investigation into the possibilities of calculating the reflection of spherical air shock waves from the ground

27 Effects of nuclear explosions on men

- (293) Oncogenic virus
- (294) Determination of sensitivity to radiation (LD 50/20) of (CBA) mice conducted from January 1968 to December 1969

28 Radiation: the effects of and protection against nuclear explosions

- (295) Fractionation properties of nuclear debris from the seventh Chinese nuclear explosion on 24th December, 1967.
- (296) Studies with a Ge(Li)-detector of mixed fission products from thermal fission of <sup>235</sup>U

3 CHEMICAL AND BIOLOGICAL WARFARE

30 Chemical and Biological warfare - general

- (297) Intensity meter for calculating suspension time functions. Report on a visit to Åbo, October 1969.

31 Examination of chemical warfare material

- (298) Studies on central and peripheral effects of anti-cholinergic drugs
- (299) The formation of 3.3'-Thenil in the reaction between 3-Thienyllithium and dimethyl oxalate at -70°C

33 Spreading and propagation (B and C warfare)

- (301) Report on 'air cleaning'. Dusseldorf, October 1969

34 Analysis and identification (B and C warfare)

- (302) Industrial hygiene measurements of ethylene oxide in working areas

- (303) Air analysis from a factory for washing material with respect to the content of microorganisms, proteins and dust
- (304) Report on experiments to derive cholinesterase from plaice
- (305) The pollen content in air from birch and willow in the Summer 1970

35 Cleaning (B and C warfare material)

- (306) Tests on personal decontamination material 1025; killing effect on bacteria and bacteria spores
- (307) Bacterial decontamination. The study of temperature conditions and cleaning effects in Army cleaning tents

36 Treatment and medical antidotes (B and C warfare)

- (308) Comments on the problem of sludge in the pulp and paper industry
- (309) Tetanus and production of tetanus toxoid for vaccination
- (310) The role of citrate in the biosynthesis of acetylcholine
- (311) On the origin of the acetyl moiety of acetylcholine in brain, studied with a differential labelling technique using  $^3\text{H}$ - $^{14}\text{C}$ -mixed labelled glucose and acetate
- (312) Thymidine and uridine metabolism at cell growth inhibition of HeLa cells by human liver extract

37 Personal protective material (B and C warfare)

- (313) Moisture penetration of clothing material supplied for field equipment - experimental methods

38 Collective protective material (B and C warfare)

(see reference (358))

4 CONVENTIONAL WARFARE

40 Conventional warfare, general

- (314) A method for compressing: description of application to tubular parts for pyrotechnics

- (315) Analysis of nitrate, nitrite and ammonia by Conway's diffusion method

42 Propellents - internal ballistics

- (316) Investigation of temperature distribution in combustion of ammonium perchlorate

43 Igniters - pyrotechnics (see reference (314))44 Ammunition - warheads - external ballistics

- (317) Investigation into splinter formation of 105 mm shell-type heavy SGR M/34 C
- (318) Calculation of ellipsoid surfaces
- (319) The capacity of splinters to penetrate. Comparison of numerical values based on experiment and calculations
- (320) The second International Conference on Fracture, Brighton 1969

45 Weapon systems - effect and protection

- (321) Standardized burns on mice
- (322) FORTRAN program for working out certain experimental data on animals (blood clearance)
- (324) The effectiveness of shrapnel. Trial method for determination of data for 75 mm HPGR M/50 and 75 mm SGR M/382

46 Drives for missiles and rockets

- (325) Fast inflation of shock absorbing gas bags

49 Technical system studies (conventional warfare)

- (326) Complete kinematic computer program analysis of finned, or rotation stabilized, controlled bodies
- (327) Simulator experiments in firing manually guided ATGW from helicopters. Part III. Numerical treatment of firing results
- (328) Construction and development of a simulator system for simulating yaw displacement of a helicopter

5 APPLIED PHYSICS51 Fundamental optical techniques

- (329) Conference on non-linear optics, Belfast September 1969
- (330) Lecture at the Physics Conference in Stockholm June 1969
- (331) Risk of injury from laser beams. Part 6. Eye transmission, movements and magnification power

52 Applied optical techniques

- (332) Coherent optics, theoretical background to diffraction, coherence analysis, holography and optical image treatment

- (333) The effect of different green colours on the temperature equilibrium of a body illuminated by the sun
- (334) Model for analysis of information acquired, by means of a multi-sensor system
- (335) Colour pictures for helping to preserve the environments

54 Guidance, navigation, control techniques

- (336) Comparison of energy consumption of electrical and pneumatic prostheses
- (337) Treatment of measured data on gyro drift by methods based on Kalman filtration
- (338) Kalman estimator
- (339) Optimal prediction - classical linear predictor
- (340) The life of wires and cords for prostheses

57 Acoustics

- (341) Performance evaluation of a passive hydrophone system
- (342) Phonetic evaluation of tests for speech comprehension

58 Surveys and technical system analysis within the field of applied physics

- (343) The laser in military technology

6 ELECTRONICS

60 Wave propagation, tropospheric-ionospheric physics

- (344) Ground conductivity determination by means of measuring field strength in the long wave range
- (345) Radar angles and their relationship to meteorological factors
- (346) The refractive index field in the lowest 2000 meters of the atmosphere
- (347) Research into propagation in the troposphere at the Research Institute for National Defence
- (348) The 16th Congress of the 'Union Radio Scientifique International (URSI)' Visit to Canada and USA

61 Electronic components and material

- (349) European Microwave Conference, London, September 1969

62 Data collection

- (350) Concerning problems of prediction for a ballistic missile
- (351) Electrodeless metal deposits for the production of microwave components



### 63 Information transmission

- (352) Calculation of cross talk diagram
- (353) Analysis of electromagnetic disturbances
- (354) An information theory approach to the source approximation problem

### 65 Radio guidance and navigation (see reference (350))

### 68 Measuring techniques (electronics)

- (355) Measuring methods - standards
- (356) Data technique for treating data from measurements

## 7 BIOTECHNOLOGY

### 72 Perception - presentation (see reference (328))

### 75 Extreme outer environment (biotechnology)

- (357) A description of a program for sorting, arranging and tabulating results measured in climatic chamber trials

### 76 The closed room problem (biotechnology)

- (358) Formation of a Nordic Association for cleanliness techniques and clean room (R<sup>3</sup>) at a Symposium in Sandefjord

## 9 REMAINING INVESTIGATIONS

### 94 Power sources

- (360) Study of clean engines for use underground

### 98 Reliability

- (361) Collation of environmental trial resources in Scandinavia 1969
- (362) Computer program for estimating the reliability of series-parallel structures
- (363) Prediction of reliability of ball bearings

## 11 MILITARY PSYCHOLOGY

### 110 Military psychology - general

- (364) The physical effects of war. A trial model for quantitative estimation. Part II

### 111 Work psychology

- (365) Manual missile guidance under short term psychological stress - a literature review

- (366) Work analysis of a conscript's duties. Part I, Background
- (367) Work analysis of a conscript's duties. Part II, Method
- (368) Work analysis of a conscript's duties. Part III, The problem of reliability

113 Educational psychology

- (369) Studies of methods concerning staff appraisal systems
- (370) Comments on training of missile aimers

114 Social psychology

- (371) Prospective army officers' understanding of the status in society of the professional army officer
- (372) Individual qualities, the effects of section composition and leader behaviour on the section's effectiveness. Part I, Analysis of and suggestions for a theoretical decision model
- (373) Part II of above, methods and results

12 PSYCHOLOGICAL DEFENCE

121 Mass communications

- (374) Egypt and Israel in the European elite press. A study of the 'structure of foreign news'

Detachable abstract cards

FRO 69/70-4

1 STUDIES

10 Planning of scientific study

(271) FOA reg. No.003-2840:1

Report on a business visit to Philips, Eindhoven, October 1969.

T. Magnusson

December 1969

The journey was made to visit the Philips Research Exhibition, where the results of scientific investigation from laboratories in the Philips group in several countries were displayed. It was an impressive exhibition of wide scope and good quality.

(272) FOA A report A0101-10

Cooperation between FOA and FMV sections.

L. Holm and I. Widegren

May 1970

The report gives the results of an analysis, carried out at the request of the Director General of FOA, of the cooperation between FOA and FMV. Chapters 1 to 6 present the background and summing up of the analysis without appraisal or consideration of the results of interviews carried out in FMV and FOA. Therewith, have been included without comment, statements which contain inaccurate information upon the formal inter-relationships. Such information has an interest as an illustration of the real situation concerning cooperation between FOA and FMV. Chapter 7 contains suggestions for taking steps to improve cooperation between FOA and FMV which are based on a survey and estimation of the results.

(273) FOA 2 report A2526-10

DIAL-LIB-program for data treatment in a reference library.

A. Magnusson

May 1970

Even small scientific groups, e.g. an institution, very quickly collect so large an amount of literature references that a rational search by means of a card index becomes practically impossible. A system of guidance cards, which has been in use for eight years by FOA institution and experimental station at Grindsjön, functions better but allowance must be made for the considerable manual effort required and the long delay.

Based on this system an ADP procedure has been developed for an IBM 360/75, where the most important information about the references is stored as directly organised data, on a memory drum. Since the system is maintained with an up to date register, a library search is greatly facilitated because

only those articles which contain the required subject combination need to be dealt with.

DIAL-LIB consists of three different programs. All input information is obtained by flexible format, and the program accurately tests all input data and writes out errors in clear text statements so that the system can be looked after by personnel unskilled in programming.

11 Methods of study

(274) FOA 1 report C1356-11

Studies on mercury metabolism in mice.

FORTTRAN programme for evaluation of whole-body measurement data.

K. Eriksson

May 1970

The report is a review of three FORTTRAN programs for dealing with experimental data obtained from studies of mercury metabolism in mice. The tests were carried out at the Institute for food hygiene, the Veterinary College, Stockholm, by K. Östlund from 1968 to 1969.

Two of the programs calculate the average value and standard error for a subsequent graphical statement.

The third program calculates the half decay period etc. by means of an iterative least-squares procedure, where one uses a function of the type  $y = a(1 - e^{-bx})$ . By means of the method described arbitrary functions can be adapted.

The program is written in FORTTRAN IV for the IBM 360/75 at the Stockholm Computer Centre.

(275) FOA P report C8250-11

Formation of plans for the future - an introductory discussion.

P. Strangert

March 1970

In order to direct planning from the present to a future time it is essential that the description of alternative action be made dynamically. A concentration on description in practical terms contributes to making this possible. Construction and presentation of decision stages can in certain respects, be given a formal description and with this help terms such as flexibility and adaptiveness can be discussed. There are further explanations of questions of principle concerning the connections between forecasting and programme planning.

The report has been carried out as a basis for FOA recommendations to OB regarding methodics for perspective planning.

(276) FKC A10:3

Data handling - word list.

(Defence Classification Centre (FKC))

February 1970

The Swedish Electricity Commission (SEK) has submitted a series of word lists having reference to data handling. They are intended for use directly in system and planning work. Since there may be a long delay before the lists are confirmed as standards, the FKC after agreement with SEK, has reproduced them for distribution within the Defence Centre.

Every section deals with an aspect and reviews the ideas in systematic sequence. Supplementing the systematic lists, FKC has worked out a Swedish and English alphabetical register where the whole assembly of terms is reviewed.

The introductory section on word lists - a review of certain fundamental concepts - is taken from Nomenclature for Administration Service, which in turn, is derived from Nomenclature 69. An addition has been made here, the term computer has the synonym 'dator'.

An appendix, which for practical reasons is placed first, includes the standard symbols already established for computer work, and flow plan symbols (SEN 013010).

The SEK stencilled issue has been used for reproduction of the word lists.

## 12 Forecasts

(277) FOA P report C8246-12

SYMTPROG and INCARD. A general input system for FORTRAN IV.

L. Enderin and L. Jansson

January 1970

The report describes a system for a flexible input system to program writing in FORTRAN IV for an IBM 360/75.

The experience from a similar system written for an IBM 7090 has been used.

The system consists of two main components, SYMTPROG and INCARD, both written in PL360, a machine language with ALGOL-like syntax.

SYMTPROG uses FORTRAN program or parts thereof as input. The program produces a table of symbols which is used by INCARD.

INCARD is used as a sub-routine in a FORTRAN program and has punched card symbols as input where the program variables can be allotted values from a related FORTRANS NAMELIST whose input is in free format.

The input described in the report has considerable advantages especially for programs with long lists of variables, when compared with NAMELIST.

13 General study activities

(278) FOA 1 report No. A1516-13

Studies in planning medical attention.

3. Application of ISMARC

S. Hasselrot and others

June 1970

A continuation of FOA 1 report A1437-13 (FRO 67/68-4 ref.276,  
see RAE Library Translation 1385 p.4).

(279) FOA P report C8252-13

Methods for explicit calculation of first and second order moments in an ordered sample of a normally distributed variable.

G Borenus and S. Wrigge

April 1970

The values in a sample from a standardised normal distribution are arranged according to size. Two essentially different methods of calculating first and second order moments are discussed. One is based on a number identity and is demonstrated by way of introduction. The other uses orthogonal transformations. Finally, some linear identities are dealt with, between the second order null point moments. The explicit results found are given in an appendix.

2 NUCLEAR REACTIONS

20 Nuclear reactions - general

(280) FOA 4 report C4421-20

Radioactive means of warfare and initiation by lasers of fusion charges.

L. Beckman and others

April 1970

A comparison has been made between some conclusions concerning the use of radioactive (radiological) means of warfare and the consequences of initiating fusion charges by lasers. The technical bases are reviewed in supplements.

(281) FOA 4 report C4426-20

Methods, with results and calculations of the variation in effectiveness, in respect of the effect of nuclear warheads on point, extended and composite targets.

R. Skoglund

May 1970

The report states some generally used functions for damage caused by the use of nuclear warheads. The methods mentioned are for solving the effects and

variation in effectiveness problems which are or are, or are judged may become, of interest to studies concerning the total effect of nuclear warheads on military and civil targets.

22 Nuclear physics and reactor physics

(282) FOA 4 report C4431-22

Nuclear physics. Conferences and study visit 1969.

L. Wallin

June 1970

The report gives impressions from two Conferences and study visits on the theme of nuclear physics. The occasion of the first journey which was undertaken in January/February 1969, was an invitation to take part in a panel on compiling neutron data, arranged in Brookhaven by IAEA (see the following reference). By cutting short this visit the authors were also able to take part in a Conference at Villars and visit Harwell, Columbia University, University of Maryland and University of Pittsburg.

The second journey took place in July-August and was made to take part in the International Conference on Clustering Phenomena in nuclei, at Bochun 21 to 24 July 1969 and also the second IAEA Symposium on the Physics and Chemistry of Fission, Vienna, 28 July to 1 August 1969.

(283) FOA 4 report C4433-22

Data Centres, who wants what and why?

A contribution to an IAEA Panel on neutron data compilation held in Brookhaven 10-14 February 1969.

L. Wallin

July 1970

The report consists of the contribution made by the author at the invitation of IAEA before a panel of experts on neutron data compilation which was organised by IAEA in Brookhaven.

The report considers the service a data centre should achieve in order to be of real use to its users. As a basis for the discussion the different types of customers and their needs are discussed. The ways in which existing neutron data centres are conducted and give their services, are considered and ways for improving them are discussed.

The conclusions and opinions given in the report are based on the author's experiences both as a member of a data centre and as a user of its service.

23 Physical investigations (nuclear)

(284) FOA 2 report B2018-23

Contributions to the physics of high energy density.

N. Gyldeén

February 1970

FOA report, Vol.4 No.1, February 1970, 3 kr.

Thesis for doctorate consisting of a number of theoretical papers published by the author and a co-worker, dealing with extreme pressure and temperature physics.

(285) FOA 4 report C4434-23

Some high pressure energy properties of uranium and other actinides.

G. Leman

July 1970

A high pressure cell has been modified for accurate determination of resistance and pressure. It functions at present, for three electrical circuits and has been used for the study of resistance of uranium up to about 600 kbar. The results, however, show no change arising from the shock wave experiment which suggested a phase change at 500 kbar.

Compression data for uranium from different experiments is discussed and analysed. The variation in the periodic system of some volume dependent quantities are discussed and the probable values of the heavy matter are suggested.

24 Chemical and metallurgical (nuclear)

(286) FOA 4 report C4422-24

Determination of gallium in gallium plutonium alloys.

1. Determination of macro-quantities (1 to 10%) gallium by means of EDTA-titration.

L. Andersson and B. Gelin

April 1970

A method has been developed for the determination of macro-quantities (1 to 10%) gallium in gallium plutonium alloys. After dissolving the test sample in 5 M hydrochloric acid and adding ascorbic acid as a reducing medium, gallium is obtained in the form of the anion complex  $\text{GaCl}_4^-$  on the anion exchange material Dowex I. Plutonium, which is reduced to Pu(III), and iron which is reduced to Fe(II), build up no anion complexes in 5 M hydrochloric acid. Any other positive ions occurring in the alloys do not attach themselves to the ion exchanger with the exception of copper and lead, which effects in the current test, take place in quantities which do not interfere with the subsequent titration with EDTA. Gallium elutriates with 0.5 M hydrochloric



acid. Titration was carried out with EDTA at pH 3.0 to 3.5 and indicator copper - PAN (temperature 75 to 100°C). The precision (standard deviation for individual determination) was 0.007 mg gallium within the percentage range 0.5 to 15% gallium in plutonium for a test sample size of 100 mg.

(287) FOA 4 report C4425-24

Spectrochemical analysis of trace elements in rock specimen.

L. Andersson and others

May 1970

The report describes current spectrochemical methods and apparatus used for the determination of trace elements in two standard test materials from Norway, Slate and Larvikite. The method was selected mainly for its application for trace element analysis and also for other types of test. Calibrations were carried out by means of synthetic mixtures, the composition of which approximated to the standard test materials to be analysed, and by means of the standard test W1 from the US Geological Survey. Beryllium and palladium were used as inner standard elements in the spectrochemical procedure. Manganin was determined also spectrophotometrically.

(288) FOA 4 report C4427-24

Method for measuring rotation speeds and applications in machining.

B. Hedlund

May 1970

A method for measuring the speed of rotation with a multi-channel analyser and photocell is described. The method gives very high resolution at low rev/min. As an example of application, it is shown how cutting power can be estimated for a turning lathe by using the dependence of the asynchronous motor speed upon the load. The same measuring equipment can be used for investigating cutting power for milling, boring, etc. where the driving motor is an asynchronous motor. Since there is no contact with the work being machined the measuring system is not affected by the machine or the tool. The cutting process of the machine can be followed at each revolution when the machine runs at even speeds which makes it possible to study any variation in homogeneity in the material.

(289) FOA 4 report C4432-24

Experimental technique in the performance of trace element analysers.

L. Andersson and R. Söderlund

June 1970

It is very important in the performance of trace element analysers, that variations in background levels are limited in relation to the measurements required. The sources of such variations are due to various causes, e.g. noise in the measuring apparatus or contamination of the specimens during preparation

and separation processes. An account is given of the experimental methods and equipment developed with the object of reducing contamination to acceptable levels. Applications, mainly in the field of spectrochemical trace element analysis of plutonium content in specimens, are discussed in detail.

26 Mechanical and thermal effects of nuclear explosions

(290) FOA 4 report C4423-26

Underwater detonations in the Baltic Sea and Skagerak in 1969 for seismological measurements.

K. Edin and H. Axelsson

April 1970

The report consists of a technical description of underwater detonations carried out in the Baltic and Skagerak for the Trans-Scandinavia seismological investigation of the earth's crust, in June 1969. The sizes of the detonation charges were 1 and 2 tons.

(291) FOA 4 report C4424-26

Data on air shock waves from nuclear explosions.

K. Edin and H. Axelsson

May 1970

Data from 'The effects of nuclear weapons, 1964' on air shock waves from a 1 kt nuclear explosion have been transformed into metric units. Curves have been prepared by interpolation from those presented in ENW. A number of examples illustrate the use of the curves and their associated scales for application to explosions of different magnitudes.

(292) FOA 4 report C4430-26

Investigation into the possibilities of calculating the reflection of spherical air shock waves from the ground.

B. Lemcke

June 1970

A brief comparison has been made between the available numerical methods for the calculation of two-dimensional non-stationary wave propagation. Only pure Euler and Lagrange descriptions have been considered in this case, mainly to find a simple solution to the problem. In the event of no solution being obtainable in this way, a development of method and complications of the methodics are considered. The possibility of including a variable atmosphere and a dissipative ground surface is referred to.

A formalism is quoted from available literature which, from earlier applications seems to be promising in the present case. A complete set of equations and their sources is given.

27 Effects of nuclear explosions on man

(293) FOA 1 report B1117-27

Oncogenic virus

B. Järplid

February 1970

Extract from Svensk Veterinärtidn, No.23, 1969

FOA reprint 1969/70:39

A paper for a lecture on tumour biology at the Royal Veterinary College.

(294) FOA 1 report C1357-27

Determination of sensitivity to radiation (LD50/20) of CBA mice  
conducted from January 1968 to December 1969.

C. Rönnbäck

May 1970

The sensitivity to radiation expressed as LD50/20 was registered over  
a routine procedure on the CBA mice kept by FOA 1. During the stated period  
of time 16 investigations were carried out on CBA/Fn animals and 6 on CBA/Lu  
animals.

Compared with earlier investigations, a 10% increase in sensitivity  
to radiation was evident in both lines of animals.

28 Radiation: the effects of and protection against nuclear explosions

(295) FOA 4 report B4037-28

Fractionation properties of nuclear debris from the seventh Chinese  
nuclear explosion on 24 December 1967.

J. Sisefsky and G. Persson

Extract from Health Physics, Vol.18 pp.347 to 356, 1970.

FOA reprint 1969/70:41.

Debris from the seventh Chinese nuclear explosion has been examined  
by  $\gamma$  spectroscopy and auto-radiographic methods. The active particles are  
extremely uniformly reddish in colour and their specific activity falls in the  
'middle class'. The picture of fractionation is normal, but fractionation is  
independent of size of particle, at least in the region 0.4 to 4.5  $\mu\text{m}$ . The  
activity released during fall out on the other hand, showed a reverse  
fractionation picture, and it was noted that the active particles and those  
released were 'mirror particles', that is both particles each represented their  
part of a breakdown of the original activity of two particles. The fission of  
these particles with respect to a number of normal  $\gamma$  radiated nuclei, has been  
calculated. Thus for example, the active particles contain approximately 90%  
of the original amount formed of mass chain 95. It has been reckoned from  
these figures that the fire ball contained 3.2 tons of iron per kg of spent

uranium. The particle spectra of different specimens of active particles are given. The theory of 'mirror particles' is discussed and also a Holmberg-Andersson model of particle formation.

(296) FOA 4 report C4420-28

Studies with a Ge(Li) detector of mixed fission products from thermal fission of  $^{235}\text{U}$ .

L. De Geer

April 1970

Gamma spectra of fission products from reactor radiation of  $^{235}\text{U}$  have been recorded and studied with a  $7\text{ cm}^3$  Ge(Li) detector. The intention was to produce the means for practical work on  $\gamma$  spectroscopic analysis of mixed fission products, e.g. in the fall out from nuclear explosions.  $\gamma$  spectra of mixed fission products of different ages are given. Complimentary to the report is a table worked out with the help of a computer, from which one can find the calculation rate for every currently known photo peak.

### 3 CHEMICAL AND BIOLOGICAL WARFARE

#### 30 Chemical and biological warfare - general

(297) FOA 1 report C1353-30

Intensity meter for calculating dwell time functions.

Report on a visit to Åbo 1 to 4 October 1969.

B. <sup>O</sup>Martensson and G. Lindner

April 1970

The report is in four parts. The first deals with more general dwell time functions and how they can be used. Of particular interest is the intensity function which can give both qualitative and quantitative information about the flow within a system. At Åbo Academy there is a so called intensity meter for automatic evaluation of dwell time functions, and the second part of the report describes a study visit which the authors made to examine the instrument. This is described together with its capabilities. The third part is a comparison between the intensity meter and FOA 1 computer PDP8 as to what are valid records and evaluation of dwell time functions. The computer appears to be cheaper and more flexible than the intensity meter and is therefore to be recommended.

The fourth part gives a report from a visit to the Chemical Central Federation and Alko in Helsingfors.

See also reference (301).

31 Examination of chemical warfare material

(298) FOA 1 report B1125-31

Studies on central and peripheral effects of anti-cholinergic drugs.

L. Albanus

April 1970

FOA reports, Vol.4, No.4, pp.1-17, April 1970. Kr.5.

Treatise for a doctorate. Abstracts and discussion of six previously published papers.

(299) FOA 1 report B1128-31

The formation of 3.3'-thenil in the reaction between 3-thienyllithium and dimethyl oxalate at  $-70^{\circ}$ .

K. Nyberg

April 1970

Extract from Acta Chem. Scand., Vol.23, pp.1087-1089, 1969.

A short memorandum

33 Spreading and propagation (B and C warfare)

(301) FOA 1 report C1360-33 (30, 34, 37, 76)

Report on 'air cleaning', Düsseldorf, October 1969.

H. Frostling and others

June 1970

The authors attended a Conference on 'cleaning the air' in Düsseldorf 13 to 15 October 1969 and visited an associated exhibition of apparatus and equipment for cleaning air, and also studied questions concerning the cleaning of air in a number of industries in the Ruhr district.

Interesting information on the present state of the art and development trends for acceptable air quality in the dense industrial areas were acquired, personal contacts were established and a large catalogue with items of literature were collected.

The Conference, exhibition and visits to industry are briefly reported.

34 Analysis and identification (B and C warfare)

(302) FOA 1 report C1354-34

Industrial hygiene measurements of ethylene oxide in working areas.

H. Frostling

April 1970

The ethylene oxide content in a factory for manufacturing field dressings has been measured by means of a portable detector of hydrocarbons. When taking measurements the apparatus was placed in direct contact with respective working positions.

The ethylene oxide content exceeded the maximum allowed content in all measuring positions in one of the premises.

Measurements were taken to carry out suggestions aimed at reducing the ethylene oxide content. Check measurements taken afterwards, showed that the content of ethylene oxide at all places in the premises where previous measurements had been made, had been reduced to 50% of the recommended maximum value for hygienic working.

(303) FOA 1 report C1358-34

Air analyses from a factory for washing material with respect to the content of microorganisms, proteins and dust.

B. Bucht and others

June 1970

Air has been collected from different places in a factory manufacturing washing materials that uses a bacterial enzyme preparation in certain of its products. The air was tested for content of bacteria, protein and dust and samples examined. The bacteria content registered in the air was not above normal for any of the samples. With the method used for taking samples for the determination of protein no indications of protein were obtained, i.e. the amount did not exceed the lower sensitivity level of the equipment, namely 5 µg. The amount of dust measured by the method was also below the sensitivity level of approximately 0.5 mg/m<sup>3</sup>.

(304) FOA 1 report C1362-34

Report on experiments to derive cholinesterase from plaice.

J. Lundin

June 1970

A half scale technical preparation of cholinesterase from the muscles of plaice has been investigated with respect to its storage potential, both as a frozen dry preparation, and in solution at different temperatures. The storage experiment has been going on for a year and shows that when stored at -18°C it will take over eight years before enzyme activity has fallen to half value, both in solution and in the cold-dry preparation. At room temperature the corresponding time is 1.5 to 2 years, assuming that the solution is radiated with röntgen rays and thereby the growth of bacteria in the preparation is checked.

(305) FOA 1 report C1363-34

The pollen content in air from birch and willow in the summer 1970.

P. Ånäs

June 1970

The amount of birch and willow pollen in the air has been studied with a 'Burkard seven day recording volumetric spore trap'. In this the air is

drawn through a column and comes into contact with a tape where the pollen (and other particles of suitable size) attach themselves. The apparatus was placed with its input opening approximately 1.4 meter above the ground in a forest in Ursvik, about 1 mile from Stockholm.

Willow pollen began to appear on 7 May, reached its highest point on 10 to 11 May and had completely disappeared by 19 May. The value during 10 to 11 May was approximately 20 pollen per  $m^3$ , but it ought to be observed that the number of willows in the area of the pollen collector was very much lower than the number of birch trees.

Birch pollen also began on 7 May, with a maximum on 13 to 17 May, and the concentration almost at its lowest level again on 26 May. At its peak the pollen measured about 50 to 60 pollen per  $m^3$ .

The investigation was made at the request of Imeco AB.

See also reference (301).

### 35 Cleaning (B and C warfare material)

(306) FOA 1 report A1515-35

Tests on personnel decontamination material 102; killing effect on bacteria and bacterial spores.

A. Bovallius

May 1970

The disinfecting effect of personnel decontamination material 102 and its water mixing properties have been tested on bacteria and bacterial spores.

Tests with vegetable organisms showed that bacteria in suspension were killed quickly with a 1% water mixture of personnel decontamination material. Dried cultures were killed at different rates depending on the material and the number of dried organisms.

The tests on spores showed that they recovered after 4 hours, but not after 24 hours contact with a 5% cleaning mixture.

(307) FOA 1 report A1517-35

Bacterial decontamination. The study of temperature conditions and cleaning effects in army decontamination tents.

A. Bovallius and others

June 1970

The tests were aimed at studying heat development and heat distribution in a decontamination tent during warm air decontamination according to the given instructions. Special care was taken in the determination of temperature both

inside and on the outside of uniforms hung up in different places in the tent. Based on the temperature values obtained the decontamination effect was studied with respect to bacteria and bacterial spores.

Results of the temperature measurements showed that the temperature conditions under standard requirements were not satisfactory. Tests designed to improve temperature conditions by adding a further unit or supplying steam were successful. Temperature build up in the tent was strongly dependent on prevailing weather conditions. The tests with vegetative bacteria showed that the killing effect was unsatisfactory in several places in the tent when decontamination was carried out to the standard requirements for 5 hours. A temperature of at least 120°C in all parts of the tent is necessary in order to achieve a satisfactory decontamination effect. Not even in the warmest parts in the tent could it be established that spores were killed.

36 Treatment and medical antidotes (B and C warfare)

(308) FOA 1 report B1116-36

Comments on the problem of sludge in the pulp and paper industry.

B. Bucht

February 1970

Extract from Svensk Papperst, Vol.72, p.154, 1969.

FOA reprint 1969/70:38

During the last year the sludge problem in the pulp and paper industry has become a new and important feature. This is not only a matter of the higher temperatures of the water returned, nor of closed cycle systems nor of increases in the use of green wood etc., but depends also on a number of other causes.

In the first place mercury preparations are forbidden. Also the use of chlorinated phenol has been severely criticised. Employers have been forced to try out new preparations. Secondly, it begins to emerge quite clearly to all concerned that a sound knowledge of microbiology will be necessary before an acceptable solution to the problem of sludge is reached. Furthermore words such as microbiology, bacteria, fungi, etc. have for many, an obscure significance, thereby obstructing a realistic discussion of the problem and tending to minimise serious attempts to solve them.

(309) FOA 1 report B1119-36

Tetanus and production of tetanus toxoid for vaccination.

B. Qacharias

1970

Extract from Försvarsmedicin, Vol.6, pp.9-13, 1970.

FOA reprint 1969/70:34.



Lockjaw or tetanus has been from earliest times one of the scourges of man. However, the disease can be controlled by inoculation.

Routine production of the toxin by reproduction of vaccine is still troublesome despite important contributions to scientific knowledge. Attempts at continuous processes have been made with increasing success.

(310) FOA 1 report B1121-36

The role of citrate in the biosynthesis of acetylcholine.

B. Sörbo and J. Sollenberg

April 1970

A short memorandum for the 6th FEBS meeting in Madrid 7 to 11 April 1969.

(311) FOA 1 report B1127-36.

On the origin of the acetyl moiety of acetylcholine in brain, studied with a differential labelling technique using  $^3\text{H}$ - $^{14}\text{C}$ -mixed labelled glucose and acetate.

J. Salienberg and B. Sörbo

Extract from J. Neurochem., Vol.17, pp.201 to 207, 1970

FOA reprint 1969/70:35

Sections of brain cortex of rats incubated with glucose labelled with  $^3\text{H}$  and  $^{14}\text{C}$  in 6 positions, and the  $^3\text{H}$ - $^{14}\text{C}$ -ratio in lactate, acetate, citrate and acetylcholine were determined. The following values were obtained: lactate 0.95, acetate 0.85, citrate 0.65 and acetylcholine 0.67 (calculated with respect to a glucose  $^3\text{H}/^{14}\text{C}$  ratio of 1.00. When the brain section was incubated with (2- $^{14}\text{C}$ , 2- $^3\text{H}$ ) acetate in the presence of labelled glucose the acetylcholine obtained had the same  $^3\text{H}/^{14}\text{C}$  ratio as the labelled acetate. The results make it probable that citrate is a precursor to the acetyl moiety in acetylcholine.

(312) FOA 1 report B1135-36

Thymidine and uridine metabolism at cell growth inhibition of HeLa cells by human liver extract.

G. Nilsson

June 1970

Extract from Exptlo. Cell Res. 59 (1970) pp.207-216

FOA reprint 1969/70:46.

Liver extract from human liver contains a check on the growth of cells which works upon HeLa-cells DNA and on RNA synthesised in vitro. Tissue extract from other species has been reported to contain inhibitors with arginas activity. The human liver inhibitor appears to lack arginas activity.

The liver extract factor gives a weak inhibition to penetration of different DNA precursors in HeLa-cells but on the other hand, gives a strong inhibition of phosphorisation and incorporation of thymidin in DNA. An increased

breakdown of thymidin-nucleoides and segregation of thymidin out to the cell cultivation medium is also induced.

Cell free extract from control cells and inhibited HeLa-cells, phosphorise thymidin at about the same rate, which suggests that the inhibition of thymidin phosphorisation, as is obtained with inhibition of growth, is a secondary effect. The primary object of attack for inhibition could be instead DNA polymer, since extract from control-HeLa-cells has higher DNA polymer activity than extract from inhibited cells. The mechanism for repression of RNA-synthesis was also studied. A deteriorated phosphorisation of UMP was observed with inhibition of cell growth.

37 Personal protective material (B and C warfare)

(313) FOA 1 report A1513-37

Moisture penetration of clothing material supplied for field equipment - experimental methods.

K. Wassholm

April 1970

The method described can be used for determining by a simple procedure, whether a C warfare type of material in liquid form can penetrate through a uniform.

Single layers of woven sateen (uniform cloth type m/59) gave poor protection against large drops of C warfare material. Much better protection was obtained with ammunition cloth (uniform cloth type m/59). Additional layers, particularly of the ribbed knitted type gave further improvement in protection against liquids.

The investigation is still in hand.

See also references (301) and (358).

38 Collective protective material (B and C warfare)

(see also reference (358)).

4 CONVENTIONAL WARFARE

40 Conventional warfare - general

(314) FOA 1 report A1514-40 (43)

A method for compressing: description of application to tubular parts for pyrotechnics.

B. Holmberg

April 1970

The method for drawing tubes for enclosing and compressing a pyrotechnic charge in a tube, is described. The method has been used for enclosing B powder (lead chromate, copper oxide and tin) in copper tubes. The tube was sawn into sections which were examined with respect to their density and burning time. The spread in density along the tube has been measured at about  $\pm 1\%$  and the spread in burning time as about  $\pm 1$  to  $2\%$ . The effect of density on burning time was investigated and further, the effects of different grain size of B powder.

(315) FOA 1 report C1364-40

Analysis of nitrate, nitrite and ammonia by Conway's diffusion method.

A. Alm and L. Zaar

June 1970

The effects by which certain factors, cell development, amounts of reagent, temperature, etc., influence analyses of nitrate, nitrite and ammonia using Conway's micro-diffusion method have been studied to a limited extent.

42 Propellents - internal ballistics

(316) FOA 2 report C2396-42

Investigation of temperature distribution in combustion of ammonium perchlorate.

V. Boboljev and others

Translation from the Russian Journal prikladnoj mekhaniki i tekhnitjeskoj fiziki No.3 pp.154-158, 1964.

S.E. Flygar

May 1970

In order to explain the reaction mechanism during combustion of compound propellents, the decomposition of the different propellant components has been studied during the last year. This particularly applies to ammonium perchlorate, because it is the most important and most often used oxidiser.

The article gives a review of temperature measurements obtained during combustion of ammonium perchlorate and discusses the combustion mechanism for both stable and unstable combustion.

43 Igniters - pyrotechnics (see reference (314))

44 Ammunition - warheads - external ballistics

(317) FOA 2 report A2522-44

Investigation into splinter formation of 105 mm shell type heavy SGR M/34C.

A. Johnsson and F. Lithén

April 1970

Object To determine how 105 mm shell type SGR M/34C splinters. To determine the ejection speed of splinters, their direction and to carry out calculations on the maximum range of these splinters under the most favourable ejection conditions.

Methods Based on exploding shells in a speed measuring apparatus which films the splinters, and in a wooden enclosure filled with sawdust designed for investigating fragmentation, and also in an explosion area where the distribution of splinters can be examined. The splinter tracks for some typical cases have been calculated.

Results The largest piece of base splinter (approximately 65-110 g) was found thrown out at  $0.3^{\circ}$  to  $1.2^{\circ}$  angle relative to the shells symmetrical axis, at speeds of 680-700 m/s. If the speed on striking the ground, is about 300 m/s these splinters can, under favourable circumstances (angle of descent  $25$  to  $26^{\circ}$ ), reach 640 to 990 meter, but probably the majority of splinters do not reach so far. The range of the base plate of the shell should certainly be less than the range of the largest shell splinter. No larger difference between the two parts could be observed.

(318) FOA 2 report A2524-44

Calculation of ellipsoid surfaces.

Bo. Janzon

April 1970

The report is a review of calculation methods and computer programs for solving the non-elementary integrals which occur in calculating the surface of an ellipsoid. The surfaces of ellipsoids are of interest in calculating air resistance to splinters.

The results are presented in the form of tables and nomograms.

(319) FOA 2 report A2525-44

The capacity of splinters to penetrate. Comparison of numerical values based on experiment and calculations.

U. Rilbe

April 1970

The report is a collection of penetration coefficients for different combinations of splinters and targets. In cases where an experimental basis exists in FOA or some other source, these values are used. In certain cases the results are worked out. In cases where such basis do not exist, estimates have been made according to the principles reviewed.

The intention is that continuous attempts shall be made to update the numerical data in the report whenever new requirements and/or experimental results are available.

(320) FOA 2 report C2400-44

The second International Conference on fracture, Brighton 1969 - a visit report.

C. Asplöf and A. Persson

June 1970

The main part of the Conference papers were in the section on fracture mechanics, aspects of micro structures at fracture, and measurements thereof. The latter field was of little interest for activities in institution 25, whilst the extensive scientific investigations within the first two named areas, despite their being mostly concerned with initiation of fracture under quasi-static conditions, yet they can be accepted as throwing light upon the initiation of dynamic loads which occur in connection with splinters and projectiles. For these equally important topics studies of the conditions for the fracture's unstable expansion after the initiating phase, was dealt with only to a small extent at the Conference.

As regards existing bases of knowledge, it appears important that the Institutions scientific investigations within the field of fracture be concentrated on the dynamic aspects of the fracture. In certain respects the material suffers shock waves through it before the fracture, and accordingly a special study is necessary of both the initiation and spread of fracture in a material deformed by shock waves.

45 Weapon systems - effect and protection

(321) FOA 1 report B1126-45

Standardised burns on mice.

B. Schildt and A. Nilsson

April 1970

Extract from Europ. Surg. Res., Vol.2, pp.23-33; 1970.

FOA reprint 1969/70:36.

The paper describes a method for reproducing standardised burn wounds on small laboratory animals. It involves an anaesthetised and shaved animal placed with its abdomen uppermost in a plastic cradle with a hole in the bottom through which the animal's back skin can be exposed to hot water in a bath. The death rate can be graded with great accuracy according to variation in time of exposure to heat by the animal.

Bacteriological and pathological-anatomical examinations have been made on the burnt skin, and haematic, haemoglobin and leucocyte numbers determined in the peripheral blood.

An LD50 wound consisted of a burn over 10% of the body surface of a 25 gram mouse for 14 seconds in water at 85°C.

(322) FOA 1 report C1355-45

FORTTRAN program for working out certain experimental data on animals (blood clearance)

K. Eriksson and M. Hansson

April 1970

The report gives detailed descriptions of programs and operating instructions for programs MUSLIN 1 and MUSLIN 2. The program develops data from studies of functions of the so-called reticulo-endothelial system in mice after different wounds.

MUSLIN 1 determines for each individual mouse, the phagocyte index and halving time by means of the least square procedure.

MUSLIN 2 calculates the mean value of halving time. It also compares the mean values in different groups by means of t-tests.

The programme is written in FORTRAN IV for an IBM360/75.

(324) FOA 2 report C2405-45

The effectiveness of shrapnel. Trial method for determination of data for 75 mm HPGR M/50 and 75 mm SGR M/382.

B. Johansson

June 1970

Object The purpose of these trials was to find a method of measuring the position of the explosion point, ignition time and orientation of the explosion point of grenades with fairly long ignition times. Also the estimation of how splinters are distributed during the tests.

Method Filming of the impact with 75 mm HPGR M/50 and 75 mm SGR M/382 when shooting against ship's plates of different thicknesses and impact angles. Plates for giving evidence of splinters were also available. Evaluation of the films were made later.

Results The method can be used with good results for shells when measuring the point of explosion position and ignition times. By selecting the right camera the orientation of the grenade at the point of explosion can be illustrated. The distribution of splinters can also be measured but in another way. Plates giving evidence of splinters are recommended as a simple check on the position of the point of explosion.

#### 46 Drives for missiles and rockets

(325) FOA 1 report C1352-46

Fast inflation of shock absorbing gas bags.

Å. Hjertstrand

April 1970

Shock absorbing gas filled bags which are normally folded and placed in the instrument panel, steering wheel hub and behind the front seats, and which can be quickly inflated in the event of an accident, provide a possible arrangement for extra protection from frontal damage to car passengers.

The whole problem is extremely complicated and the report is limited to a study of the possibilities in principle of using a gas generator with an explosive charge or alternatively, an inert gas from a high pressure container. The desirable pre requisite of being able to inflate such a bag in approximately 20 ms appears feasible for both alternatives. The need for space and certain other factors which arise all favour the principle of gas generation by an explosive charge, provided the secondary effects of the gas generated, are acceptable.

Among other uses where gas inflation is especially suitable, are in compact and easily built in shock protectors for landing packages from the air in both civil and military applications.

#### 49 Technical system studies (conventional warfare)

(326) FOA 2 report A2527-49

Complete kinematic computer program analysis of finned, or rotation stabilized, controlled bodies.

K. Andersson

June 1970

Since the 1950s FOA has produced a large number of studies on unguided or simple controlled weapons in connection with the FOA contribution to studies of performance.

In 1968 an additional need arose to carry out re-programing of some earlier programs made for IBM360 and for recent studies on rocket trajectories and dispersions. For this purpose the earlier equations used were transformed so that higher rotation speeds could be studied within reasonable computer time and cost.

The report reviews complete motion equations for a rigid body with three dimensional displacement and six degrees of freedom. These equations are the basis for representation both as a digital program for an IBM360 and as a

program for the FOA hybrid computer. In these programs (simulation models) a projectile, a shell or rocket trajectory can be studied at a cost considerably lower than the cost of firing a single shot. In the program studies can be made on the effect of disturbances as well as on changes in parameters; e.g. speed of rotation or aerodynamic derivatives on either the whole trajectory (for example, gyro precession) and/or, resulting dispersion (sensitivity to disturbances). The report, in its non-general sections, deals with immediate problems in connection with the digital program.

Preliminary comparisons between calculations and the firing table (for 155 mm shells) indicate for example, that the difference in precessions is +5% and that the difference in wind sensitivity and time of flight shot pattern is quite negligible.

The program is intended for systematic studies by FOA on shell, reaction and rocket trajectories and their sensitivity to disturbances together with the circumstances that affect them. Users of the program for other applications are referred to section FOA 2.

The future work planned concerns for example, a comparison between calculated and fired trajectories (the whole trajectory as well as the aeroballistic trajectory).

(327) FOA 2 report C2388-49

Simulator experiments on firing manually guided ATGW from helicopters.  
Part III. Numerical treatment of firing results.

K. Berggren and C. Borg

April 1970

The report is concerned with the data program for a simulated firing of ATGW from a simulated helicopter environment. During June 1968 attempts were made to determine the reduction in hit probability when the shot was made from a vibrating environment. The experiments were continued from March to May 1969, when helicopter movement was taken into account.

Complete firing results from the simulator experiment are given in a separate appendix presented in the form of tables and histograms for each environment.

(328) FOA 2 report C2391-49 (72)

Construction and development of a simulator system for simulating yaw displacement of a helicopter.

R. Andemark and others

April 1970



FOA studies have been made on armed military aircraft and experiments carried out in a simulator with the object of obtaining data on the reduction in hit probability of an ATGW, when under the influence of yaw displacement in a helicopter.

The report deals with the construction and development of the simulator system. Different parts of the simulator consist of a turntable with servo system, tape recorder, missile simulation equipment and a camera system.

## 5 APPLIED PHYSICS

### 51 Fundamental optical techniques

(329) FOA 2 report C2394-51

Conference on non-linear optics, Belfast 8 to 12 September 1969.

R. Lidholt

May 1970

The object of the author attending the Conference was to take note of the rapidly expanding field in non-linear optics, which has received much attention with the development of high power lasers. Specially reported on, is the development of liquid laser techniques. An exhibition of laser activities at Queen's University, Belfast is described, and also a laser exhibition in connection with the Conference. Study visits were made to Laser Associates Ltd. and a summary of impressions derived is given.

(330) FOA 2 report C2395-51

Lecture at the Physics Conference in Stockholm 4 to 6 June 1969.

T. Bergqvist and others

May 1970

The report presents abstracts of FOA 2 lectures given at the Conference. The lectures were in the field of optical physics.

(331) FOA 2 report C2406-51

Risk of injury from laser beams. Part 6. Eye transmission, movements and magnification power.

A. Hedin

June 1970

The eye is the organ which runs the greatest risk of injury from visible laser beams, e.g. from a ruby laser. The reason is that the eye's lens focuses the light onto or near to the retina. The focal distance of the eye is about 17 mm. Injury occurs to the retina or neighbouring tissue. In calculating the risks of injury the optical properties of the eye are significant, such as the magnification power, absorption and diffusion. A continuous beam from a laser also affects movement and reflexes of the eye.

The report summarises published data on these factors. From this it can be estimated that about 56% of ruby laser light entering the eye, is absorbed in the retina and outer surrounding veins. The diameter of the injury on the retina is typically 20  $\mu$ m (80% of the light beam within the circle).

52 Applied optical techniques

(332) FOA 2 report C2389-52

Coherent optics. Theoretical background to diffraction, coherence analysis, holography and optical image treatment.

T. Orhaug

April 1970

The report gives a survey of lectures on certain aspects of modern optics, which the author gave at FOA at the end of a course on optics for electronicists, in February 1969. The report deals with certain aspects of the diffraction theory which are necessary for a deeper understanding of holography and optical signal treatment. The theory of partial coherence is discussed, among others, from a radio starting point, and certain of the theory's applications are considered. The treatment of optical signals starts from the theory for a linear system and some of its applications are discussed.

(333) FOA 2 report C2403-52

The effect of different green colours on the temperature equilibrium of a body illuminated by the sun.

D. Glansholm

June 1970

The reflection factor, as a function of the wave length of different colour samples, has been determined. Thus the absorption factor of bodies for sun radiation has been calculated. The exchange of radiation between a body and its surroundings has been investigated and the final temperature when radiation is equalised has been calculated. The results show that the property of reflection within the visible part of the spectrum is of dominant significance for equalization of temperature. Bodies painted with green colour which to the eye appear to be equally dark, can be assumed to reach the same final temperature. The experiments made do not contradict results of theoretical calculations.

(334) FOA 2 report C2393-52

Model for analysis of information acquired by means of a multi-sensor system.

J-O. Eklundh and T. Orhaug

May 1970

The report discusses a possible model for analysis of acquired information (reconnaissance) where several sensors (means of reconnaissance) are used.

The model developed from a representation of the information requirements and the sensors as quantities in a multi-dimensional space. The relation to a classical theoretical information concept is discussed. The possible application of the model to analyses of current problems are discussed with examples.

(335) FOA 2 report C2397-52

Colour pictures for helping to preserve the environment.

Extract from FOA Journal No.1/1970.

C-H. Ågren and S. Larsson

May 1970

Colour photography from the air plays a most important part in the work of preserving the environment. One of the methods developed depends on using different types of colour film in combination with various kinds of filters. In this way differences in shades in the object reveal outlines that would otherwise be obscured. This paper reviews the investigations carried out by FOA in this field in association with the work of preserving nature.

#### 54 Guidance, navigation, control techniques

(336) FOA 2 report C2390-54

Comparison of energy consumption of electrical and pneumatic prostheses.

M. Wager

April 1970

The report presents an approximate calculation of the number of movements that can be made per battery charge, for electrical and pneumatically driven functions respectively, on two prostheses. The 'batteries' used in these cases were a commercially available Ni-Cd battery and carbonic acid gas bottle respectively; they constitute the normally used energy sources for operating prostheses. Where some of the statistics for the groups of different movements did not exist, calculations are made for a number of typical movements. The investigation was part of project I of the SVEN groups' development of an electrically operated hand prosthesis financed by STU.

(337) FOA 2 report C2399-54

Treatment of measured data on gyro drift by methods based on Kalman filtration.

P. Wolff

June 1970

A method is described by which one can:-

- (a) Calculate dispersion as a function of time for gyro drift from available drift data, e.g. manufacturer's specifications,
- (b) Calculate as realistic a value as possible from the measurements and superimposed noise taking the given drift data into account,
- (c) Calculate the dispersion due to drift as a function of time after a constant correction in drift rate.

The method can be seen as an application of certain Kalman theories to gyro drift. The work is a result of (a) an inquiry concerning standardized principles for the specification and testing of gyroscopes, (b) preparation for evaluating the gyroflex procured by FOA.

(338) FOA 2 report C2401-54

Kalman - Estimator.

T. Schütt

June 1970

The report describes the theory of Kalman estimators, continuous, sampled and discrete, and attention has been given to non-optimum estimators.

The report also presents the ground work for a computer program for the analysis of both optimum and non-optimum, sampled and discrete, Kalman-estimators. The program is known under the title FOA 2 report 'computer program for analysis of a collected Kalman-estimator'.

(339) FOA 2 report C2402-54

Optimal prediction - classical linear predictor.

T. Schütt

June 1970

The report deals with the problem of predicting a non-stationary stochastic input signal during a certain observation time in an optimal manner and with the minimum error. The assumptions under which the optimal prediction is linear are shown together with the method for determining the prediction's transfer matrix and structure, as well as the optimal prediction errors obtained for a given input signal, observation and prediction time.

The classical methods for synthesis of estimators studied in the report (Wiener-estimation of gaussian stationary processes and Booton-Shinbrots method for non-stationary processes) both have serious limitations which strongly influence their practical usefulness.

Both the methods can be said to be conceptual answers and require fairly advanced mathematics, unsuitable for numerical treatment. The transfer function of the optimal estimator satisfies the Wiener-Hopf-Booton integral equation, which can be solved with Wiener and Shinbrots' technique. To determine the estimator's structure through the transfer function at this stage, is no trivial task.

The methods are mainly suitable for synthesis of simple systems (one input and one output signal) and make it difficult to generalise for arbitrary multi-variable systems.

The disadvantages and limitations mentioned above do not apply to R.E. Kalman's theory of estimation, which it is hoped to deal with in a future report.

The work was carried out in the Autumn of 1966.

(340) FOA 2 report C2404-54

The life of wires and cords for Prostheses.

K. Spets

June 1970

In certain prostheses, wires or cords are used in the construction which correspond to sinews in a natural limb. In such cases the lines have to pass over and bend round a number of pulleys. When the pulleys have a small diameter because of space limitation, a high bending stress occurs in the line which causes a shorter useful life.

The life of some commercially available types of lines suitable for the construction of prostheses, has been examined in a machine built for this purpose.

The report gives a description of the machine, and the results are presented in the form of a diagram.

The work was financed by STU and concerns SVEN project I.

#### 57 Acoustics

(341) FOA 3 report C3621-57

Performance evaluation of a passive hydrophone system.

L. Götherström

April 1970

The report evaluates performance for a passive hydrophone system which operates with simultaneous detection in several directions. The system is constructed around a circular hydrophone assembly with restricted geometrical dimensions. Correlation of detection of signals is used, and the signals are sampled and delayed in delay circuits of the shift register type. The report gives special attention to (1) The directivity for different signal levels and for different frequency bands. (2) Accuracy of bearing at low signal strength conditions. (3) The systems signal/noise capability.

These three points are evaluated for a simplified model of an isotropic noise field and for a number of hydrophone assemblies within the prescribed volume  $\phi$  2.5 m  $\times$  0.6 m.

Treatment of point (1) results in recommendations for the appropriate frequency range and pre-filtering circuits.

Under point 2 some methods are compared for bearing interpolation by means of Monte Carlo techniques.

Two 'sliding average' methods are studied as regards limitation of dynamic bearing errors. Finally, the result is compared with Cramér-Rao's lower limit for the bearing variants.

The results show that the interpolation methods used for bearing estimation give acceptable results. The bearing spread for a single ring plane hydrophone assembly is the same size as the lower limit, according to Cramér-Rao. An error however, occurs in the form of a mean value displacement of  $0.15^\circ$  to  $0.2^\circ$ .

Under point 3 two models of the isotropic noise model have been tested for evaluating the signal-noise handling capacity, viz the mean value and the variance of the system output. Broadly it gives a rough estimate of the accuracy of the mathematical noise model. The signal to noise behaviour is given for example to an accuracy of about 3 dB.

(342) FOA 3 report C3622-57

Phonetic evaluation of tests for speech comprehension.

S. Sjögren

March 1970

An investigation of different methods for measuring the comprehension of speech in a transmission system has resulted in the development of a so-called 'acceptable word test'. This method has been tested on four different low pass filter systems and has subsequently been used for testing a system containing noise disturbances in the telephone band width. As a result of both of these series of trials, phonetic comments are given which amount to limitations of relative comprehensibility of the initial consonant phonemes and their tendency to confusion.

58     Surveys and technical system analysis within the field of applied physics

(343) FOA 2 report C2398-58

The laser in military technology.

B. Kleman

May 1970

The report is a guide to the different categories of the military application of lasers. At present their use is mainly for information links, battlefield communications, fire control and guidance techniques. The conditions for laser beam weapons are discussed. It is considered that the technical conditions will exist in the near future for some form of beam weapon. The

technical level of laser development also depends on its connections with its application as an optical means of initiating nuclear explosions. In conclusion, the problem of protection when using lasers is discussed.

## 6 ELECTRONICS

### 60 Wave propagation, tropospheric-ionospheric physics

(344) FOA 3 report A3743-60

Ground conductivity determination by means of measuring field strength, in the long wave range.

M. Bröms

May 1970

A radio wave propagating over the surface of the earth is influenced by the earth's electrical properties which affect its amplitude and phase. These are described as the earth constants: conductivity ( $\sigma$ ) and dielectric constant ( $\epsilon$ ). Of these  $\sigma$  is dominant in the long wave range. The method of determining earth conductivity in the present case is based on a comparison between calculated and measured signal strength curves.

The measurements used were made during the year 1967-8 over 20 km stretches distributed over practically the whole country. Some transmitters in the Decca-navigation chains were used which cover Sweden and operate within the frequency range 70-130 kHz.

The measurements indicate that conductivity dependence on the time of year is insignificant over the frequencies used. On the other hand a certain frequency dependence is present. The values obtained for  $\sigma$  varied little, almost all fell between 2 and  $7 \times 10^{-4}$  S/m. The lower values were measured in Norrland's interior at  $\sigma = 3$  to  $4 \times 10^{-4}$  S/m. In North West Svealand and Småland the values were 4 to  $5 \times 10^{-4}$  whilst in East Svealand and the rest of Gotaland the values were a little over  $5 \times 10^{-4}$  S/m. Only in South Skåne were  $\sigma$  values significantly higher. Results expressed in Siemens/metre (Ohms<sup>-1</sup>/metre).

(345) FOA 3 report B3016-60

Radar angels and their relationship to meteorological factors.

H. Ottersten

April 1970

FOA report, Vol.4, No.2, pp 1-33, April 1970, Kr.9:

A theoretical and experimental study of meteorological explanations for the occurrence of radio angels, with special regard to variations in refractive index in a clear sky. 'Hosts of angels' (skitänglar) are considered to come from such variations in refractive indices whilst 'point angels' (punktänglar) are thought to be mainly due to insects and birds.

(346) FOA 3 report B3017-60

The refractive index field in the lowest 2000 meters of the atmosphere.

S. Wickerts

April 1970

FOA reports, Vol.4, No.3, pp 1-16, April 1970, Kr.4:-

The propagation of radio waves is strongly dependent on the atmospheric structure and especially on the structure of the refractive index field. Interaction between radio wave propagation and the atmosphere can be determined by means of Maxwells field equations. In certain cases it is possible to treat the problem by introducing the laws of geometrical optics when the vertical component of the airs' refractive index is dominant, in another case, for example in connection with propagation and reflexion, it is the small scale fluctuations which are important.

The report deals with both large scale variations and small scale fluctuations. For the sake of clarity the results have been presented in two parts. Part 1 deals with the vertical distribution of the airs' refractive index, especially in ducting layers. A method that predicts ducting layers has been tested with the help of the observational material collected from this recommendation for certain procedures for more reliable predictions have emerged.

Part 2 deals with small scale fluctuations in the refractive index field. Different parameters which characterise the fluctuations are discussed. A model of the atmosphere which was applied earlier to determine the field strength with radio waves agreed very well with the collected data.

The investigation has been made with the aid of an airborne refractometer. The airplane has made it possible to make measurements for both the vertical distribution of the refractive index and the small scale fluctuations along horizontal surfaces.

(347) FOA 3 report B3018-60

Research into propagation in the troposphere at the Research Institute for National Defence.

A. Blomquist

Extract from Radio and Television, No.11, 1969

FOA reprint 1969/70:37

The troposphere or the lower part of the atmosphere, has interested scientists since they began to use microwaves for radio communication. Theoretically, propagation of these signals should be only from horizon to



horizon. But it sometimes happens that the signals propagate via the troposphere and reach far beyond the horizon.

Hitherto the effect of the propagation mechanism on the signals from time to time has not been understood with any great accuracy which gives rise to the problem of inter modulation disturbances between neighbouring transmitters. One aspect of this is that for defence purposes, control must be exercised over transmitted radio and radar signal ranges in order to avoid detection.

In the FOA 3 section of the Institute for National Defence there has been for some years now, intense research in this field. Some of the results are reviewed. It is hoped to learn enough about the troposphere to be able to use it for a tropospheric link (e.g. to transmit data) and to make meteorological observations by means of microwaves.

(348) FOA 3 report C3624-60(68)

The 16th Congress of the "Union Radio Scientifique Internationale (URSI)"  
visit to Canada and USA.

N. Lundquist and others

May 1970

A shortened account is presented of the activities of the URSI general meeting in Ottawa in August 1969. The work of Commission I, scientific radio measurements and standards, and Commission II, radio and ionised media, were followed with particular attention whilst work in the executive committee, Commission VI, radio waves and circuits, and Commission VII, electronics were only partly attended by the FOA personnel. In connection with, and after the meetings, a number of visits were made in Canada and the USA. Impressions from these study visits are briefly described. The study visits were partly of a general information nature and partly specialist directed. The latter covered current scientific radio measuring and instrument techniques, also activity in radio techniques, radio wave propagation through the troposphere and ionosphere, and finally, problems concerning propagation of radio waves over rough surfaces.

61 Electronic components and material

(349) FOA 3 report C3636-61

European Microwave Conference, London, September 1969

P. Tamm and others

June 1970

The report contains impressions of the first European Conference on microwaves. The authors took part in the proceedings, and noted results of current scientific research in the field of microwaves. One of their number, L.D. Wernlund read a paper.

62 Data collection

(350) FOA 3 report A3738-62(65)

Concerning problems of prediction for a ballistic missile.

T. Bohlin

May 1970

The problem of measuring and predicting a ballistic missile by radar is treated theoretically. The problem is defined as one of statistical decision. Its optimal solution is not easy to achieve in practice, however the problem definition allows determination of a lower limit to prediction accuracy based on Cramér's inequality.

The problem divides into 3 parts: determination of radar parameters, analysis and measurement of radar echo, and estimation of the missile track. These problems are dealt with separately, and non-optimal solutions are chosen from partially heuristic arguments. The solutions are appraised according to their 'effectiveness', i.e. the resulting prediction accuracy compared with the corresponding Cramér lower limit.

Formulae are derived for input measurements and the accuracy of prediction together with upper estimations of effectivity losses.

The results are illustrated by calculations of a missile track over a measurable range of 500 km and a radar station, with actual data.

(351) FOA 3 report C3627-62

Electrodeless metal deposits for the production of microwave components.

E. Ljungdahl

May 1970

The report sets out proposals based on studies from literature, for a procedure to produce microwave components by means of the catalytic deposition of metal on substrates, or cores of aluminium, or other conducting or insulating material. Metal deposits of this type are superior to conventional electrolytic deposits, particularly where metallising is required in narrow grooves and holes.

63 Information transmission

(352) FOA 3 report A3739-63

Calculation of cross talk diagrams

U. Tegth

May 1970

The report gives a description of the worst radiated disturbances that a receiver can obtain from a single transmitter. The frequency of the disturbing signal is stated and its level estimated. From the results obtained practical cross talk diagrams can be constructed for the given transmitter

and receiver with the distance as parameters. Calculations are made with the data. A programme of tests on army radio stations RA140, 145 and 42 has been prepared.

(353) FOA 3 report A3740-63

Analysis of electromagnetic disturbances.

U. Tegth

May 1970

Interference between radiations from antennae of a communication installation is described and the frequency composition and power levels are given. Calculation of the interference level in a receiver caused by surrounding transmitters is shown in a flow diagram from which a computer program has been derived.

(354) FOA 3 report B3019-63

An information theory approach to the source approximation problem.

T. Ericsson

Extract from Ericsson Technics No.1, pp 23-65, 1970

FOA reprint 1969/70:40.

The problem of approximating a stochastic time series is approached from a theoretical information starting point. The theory developed is based on McMillan's theorem and the idea of entropy. Two sorts of approximation processes are dealt with: finite unbranching Markov sources and periodic processes. Both sorts are shown to have desirable characteristics for purposes of approximation.

The approach is not exhausted and the theory described must be considered as preliminary.

65 Radio guidance and navigation (see reference (350))

68 Measuring techniques (electronics)

(355) FOA 3 report C3625-68

Measuring methods - standards.

P. Persson

June 1970

Standardisation of measuring methods has drawn increasing interest within the field of electronic measuring techniques. The reasons are many: the extent and range of the measurements and the costs they give rise to, the desire to use expensive instruments to best effect, the need for clarity and meaningful measurements when test results are to be considered and so on. The report is intended to give an overall picture of the development situation in this field, and was occasioned by work in connection with co-operation in

standardising measuring methods with the Electronic Delegations Committee for measuring methods.

(356) FOA 3 report C3628-68

Data technique for treating data from measurements.

Report on a visit to and a course in USA 17 January to 15 February 1970

B. Engström and G. Wilhelmsson

May 1970

The visit was for training in system knowledge with extra studies for development of programming and technical system design as well as for acquiring a certain familiarity in administration of the Data Analysis System delivered to FOA. Study visits were also made to contractors of special units.

See also reference (348).

## 7 BIOTECHNOLOGY

72 Perception - presentation (see also reference (328))

75 Extreme outer environment (biotechnology)

(357) FOA 1 report C1351-75

A description of a program for sorting, arranging and tabulating results measured in climatic chamber trials.

S. Löf

April 1970

A series of trials has been carried out with the object of establishing mans physiological and psychological reactions to cold stress. The report describes the editing of trial data for input for treatment by a FORTRAN IV program in a IBM 360/75 computer. The internal editing and adaptation is described with graphs and flow diagrams.

The results are presented in tabular form so that an estimate of the effect of Na substitution on measured parameters is facilitated. Similarly the tables have been edited so that formation of hypotheses on the physiological manifestations of cold stress are made possible.

76 The closed room problem (biotechnology)

(358) FOA 1 report C1359-76 (37, 38)

Formation of a Nordic association for cleanliness techniques and clean room (R<sup>3</sup>) at a Symposium in Sandefjord.

G. Ringqvist

June 1970

The author took part in a meeting with the interim managers of the Nordic Association R<sup>3</sup>, the Annual Association Meeting, and in connection with it, the separate Symposium on technique of cleanliness and clean room at Sandefjord in

Norway between 7 and 10 April 1970. On this occasion the Nordic Association R<sup>3</sup> was constituted and elected its first ordinary management.

The report gives a short account of the background to the Association's formation and the objects it is intended to fulfil, further, the subject lectures given at the Symposium are listed.

See also reference (301).

9 REMAINING INVESTIGATIONS

94 Power sources

(360) FOA P report A8160-94

Study on clean engines for use underground.

J. Zeilon

June 1970

Since 1965 FOA has been working on the problem of obtaining a cleaner engine for a mine vehicle; the problems arising are exhaust gases, vibration and noise of the engine which uses normal fuel/air combustion. The work pursues solutions developed by the Svenska Flygmotor AB and AB Rollab during the years 1962-65 for a project which they put forward for the Swedish Navy in 1964.

During 1964-65 the idea grew that underground transport, e.g. such as used in our iron ore mines - could be used from both a technical and economic point of view, as a realistic sample for evaluating future engine systems favourable to the environment. In this connection, contact was established with Svenska Gruvföreningen, LKAB, and the Grängesberg Company. With financial support from the Malm foundation it was possible for the work to continue in 1967-68, as described in this report.

FOA has had responsibility for the activities described but with substantial support from outside FOA (studies of heat capacitance and encapsulation by aluminium smelters) orders from Svenska Flygmotor (calculation and construction of heat accumulators) and AB Rollab (heat technique calculations, installation drawings, etc.) likewise from the Institute for Metal Research, Chalmers Tekniska Högskola, and certain industrial undertakings. The studies have led to valuable contacts with authorities and private firms in USA and England, whose experiences to a large extent, can be used.

The report gives a review of how the studies have been generally applied and the results.

98 Reliability

(361) FTL A report A1009:28

Collation of environmental trial resources in Scandinavia 1969.

L. Pejler

April 1970

The collation comprises equipment and establishments concerned with environmental trials of electrical, mechanical and pyrotechnical material. The report is based on both the earlier issue of the corresponding report A1009:2A of September 1967, and on answers to a new inquiry sent to collect information from known old reports and later work undertaken in institutions within Scandinavia who have equipment for environmental testing.

(362) FTL A report A1010:40

Computer program for estimating the reliability of series-parallel structures.

J. Ocklind

December 1969

The computer program described allows a simple and fast estimation of functional probability and system availability starting from its reliability block diagram.

The program is not constructed for a highly ambitious level but has been developed to carry out calculations of a routine character.

As always with transference of manual methods to computer handling, possibilities are opened up for a more precise result because of the speed of the machine.

The program is written in FORTRAN IV.

This program together with 'Redund' program as used for calculating the functional probability for m-of-n-connections is available in FTL section, No.984.

(363) FTL A report A1010:41

Prediction of reliability of ball bearings.

F. Sandin

May 1970

Mechanical components often have ageing characteristics. The report is intended to illustrate the reliability of ball bearings with respect to these characteristics. In connection with predictions it is important to formulate relationships which express the bearings status as a function of running conditions and the environment. Furthermore, emphasis should be put on the role the component's application plays in the formation of the reliability model.

Among mechanical components, the ball bearing can be said to be well provided with basic information which can be expressed in terms of reliability. Starting from this point it should be possible to carry out a relatively good estimate of the bearing's effectiveness in different constructions.

11 MILITARY PSYCHOLOGY

110 Military psychology - general

(364) MPI B report 46

The physical effects of war. A trial model for quantitative estimation.  
Part II.

A. Hallström

June 1970

The central part of the report is a description of those instruments, etc. which are intended for use in the investigations suggested in Part I (MPI B report 35, FRÖ 69/70. RAE Translation 1509, Abstract 256). The objective is the ability to predict the performance of troops in action on the basis of their performance and attitudes in peacetime. In addition to this, criteria are presented for estimating the physical effects of combat and recovery of temporary combat losses, together with a definite basis from which to estimate (with respect to their significance for the physical effects) the extent of physical losses in combat.

111 Work psychology

(365) MPI Reports 1

Manual missile guidance under short term psychological stress. A literature review.

B. Bergström

March 1970

Parts of the literature on performance under stress have been reviewed with emphasis on short term threat or failure-induced stress in relation to tracking and psychomotor behaviour. Social and personality factors have been disregarded. The results achieved in the reviewed studies are to a large extent inconsistent. However, a few findings appear to have some generality and are summarized as three hypotheses: (a) the relation between degree of stress and tracking performance is represented by an inverted U-shaped function, (b) the more difficult the task, the greater the deterioration under stress, and (c) the higher the learning level in the task, the less deterioration under stress. Implications for present systems evaluation are that hit probability will decrease significantly under combat stress, but may improve if the operators are given time to adapt to the threat. Regarding system design it is

recommended that man's task should be as simple as possible, no more complex than an amplifier, and the required bandpass less than three radians per second. The operators should also substantially over-learn the task.

(366) MPI B report 43

Work analysis of a conscript's duties. Part I Background.

U. William-Olsson

April 1970

In 1963 work began on analysing the duties of conscripts in the Defence forces. The object was to state the requirements for a conscript so that he could be placed suitably in a given situation. In co-operation with the authorities the work has been finished as regards the education phase and this is reviewed in a number of partial reports of which this is the first.

There are certain difficulties in analysing military activities, particularly because of the many duties to be analysed and the difficulty of judging the duties and their functions under peaceful conditions.

A certain amount of information has been obtained from experiences in the USA, France and Norway.

(367) MPI-B report 44

Work analysis of a conscript's duties. Part II Methods.

U. William-Olsson

April 1970

The work analysis covered about 1300 types of duty. These have been described with the help of a questionnaire and analysed by 174 judges from military staffs and units. The material collected has been dealt with by MPI in so far as psychological variables are concerned. As a result, a structure has been built up from the material collected, which has three factors: these are known as 'discipline - and suitability for soldiering, physical combat suitability, and general ability'.

In order to obtain the relationships between duties, a point system was devised for each variable contributing to a factor. The total of points for each factor were transformed to minimum requirements which were directly related to the supply (test results) and demand (requirements).

Results from the psychological inquiry are the basis of the military personnel's opinions.

The report also discusses how these new requirements and system of selection can effect the selection for certain duties which hitherto have been made by special selection tests at the units.



(368) MPI-B report 48

Work analysis of a conscript's duties. Part III The problem of reliability.

U. William-Olsson

June 1970

Some 200 appraisers took part in the work of analysing duties. The appraisals included a large number of variables and factors built up from these variables. Checks carried out showed how the appraisal was divided between appraiser and the occasion of the appraisal. Certain planned checking investigations could not be made mainly because of the difficulty of checking mutual influence between appraisers.

Variations in the appraisers were greatest after the regrouping of the information into factors. This could be for two reasons: (a) certain relations between the duties were not seen until after the grouping had been carried out; (b) the appraisers may have interpreted the factors differently from the variables in meaning and content.

113 Educational psychology

(369) MPI B report 41

Studies of methods concerning staff appraisal systems.

B. Feuer and L. Philipson

March 1970

Methods have been studied with the object of improving the procedure for staff appraisal in connection with the appraisal of selection and training results operating with conscripts. The requirements of an appraisal system are that (a) it should have relevance to 'combat suitability', (b) imply a high degree of differentiation between appraised individuals and (c) it can be applicable to all categories of military duties. The studies consist of putting forward appraisal variables, investigation of the confidence displayed by those who make the appraisals in the variables presented and the reliability of the appraisers.

The enquiry embraced 831 conscripts in the army and 58 in the Air Force. 40 appraisers co-operated. The procedure consisted of 17 variables in personality. The factor analysis were grouped into four factors: 'go ahead spirit'. 'self-confidence', 'adaptability' and 'comprehension'.

The confidence level found varied between appraisers and to a smaller extent, within an individual appraiser. (Confidence in the appraisers also changed between different kinds of troops.)

There was a great variation in the inter-reliability of appraisers, which varied between 0.30 and 0.90 for different appraisal. The variation can be interpreted as an expression that the formula was not fully understood by the appraisers.

The results also show that the appraisal system may possibly be less suitable for non-commissioned conscript officers than for the remaining conscripts, which is a restriction on the usefulness of the system. The differentiating capacity of the variables is high as tested.

(370) MPI B report 47

Comments on training of missile aimers.

P. Arnberg and T. Lövenkvist

June 1970

The most important duty of the instructor is to create motivation in his students. He should impart the procedure and object of the training as soon as possible. Each instructor should supervise not more than six students. Fundamental training consists of the following components: (a) learning elementary control technique, (b) learning correct missile tracking ('guidance strategy'), (c) revision. Comparisons between statistics of results from simulator training and actual shooting should be kept.

114 Social psychology

(371) MPI B report 42

Prospective Army officer's understanding of the status in society of the professional Army officer.

O. Frändén

March 1970

The results show that a majority are of the opinion that the professional military officer does not set store on his earnings as a general rule. The prestige of the officer profession relative to eight other professions is rated more highly than is believed to be the opinion of civilians.

Large majorities think it depends on an increase in earnings for their own corps of officers, whilst they think the problem less acute for officers in other corps.

A small minority feel that it is improper for an officer to associate mainly with civilians. The prospective officer reckons that those who are already officers have a more restrictive opinion, although the active officer in fact appears to be less restrictive. Active officers, represented by cadets of MHS, are also more liberal than the prospective officers regarding professional occupations of wives and officers participation in party politics.

Prospective officers take a greater interest in university activities and technical college studies than do the non-commissioned officers. However, prospective non-commissioned officers take less interest in the officers than vice versa. A large majority prefer civilian clothes in their free time. The majority receive support from their families in their choice of a military profession. During the training, however, this support seems to be less.

(372) MPI B report 45

Individual qualities, the effect of section composition and leader behaviour on the section's effectiveness. Part I Analysis of and suggestions for a theoretical decision model.

B. Eneroth

April 1970

The investigations have had two main objectives:-

(1) Which individual behaviour and (2) which leaders' behaviour, increases the probability of high section effectiveness? The investigations are published in two parts. The first part deals with the theoretical basis whilst the second (MPI B report 49 June 1970, see below) reviews methods and results from an experimental examination. The theory is based on a descriptive theoretical decision model. Section effectiveness is measured by judging the behaviour of an armoured car's crew under simulated wartime conditions. Individual qualities are measured by means of Osgood's semantic differential and a rigidity test together with a questionnaire dealing with general adaptation and contentment in the military situation. The leaders' behaviour is measured by a questionnaire in which the conscripts describe the leaders' behaviour.

(373) MPI B report 49

Individual qualities, the effect of section composition and leader behaviour on the sections' effectiveness. Part II Methods and results.

B. Eneroth

June 1970

The investigations have had two main objectives, namely to investigate (1) what individual behaviour and (2) what leader's behaviour, increases the probability of high section effectiveness. The investigations are published in two parts. The first part deals with the theoretical basis as described in MPI B report 45, April 1970, whilst the second part reviews the methods and results from an experimental investigation.

The following seven characteristics were found to have a bad influence on effectiveness (1) negative assessment of "military defence", (2) negative assessment of "conscription", (3) high positive assessment of "himself" (i.e. the person you think you are), (4) negative assessment of "the person you

should be" compared with the person "you think you are". (5) Large difference between the assessment of "the person you should wish to be" and "a conscript". (6) Large difference between assessment of "the platoon commander" and "what you think you are". (7) Large difference between the assessment of "the platoon commander" and "the conscript".

The following five kinds of leader adaptation had a bad influence on effectiveness: (1) The platoon commander is seldom pleased with a given effort. (2) The platoon commander does not encourage initiative from the members of the crew of the armoured vehicle. (3) The platoon commander does not interest himself in the members of the crew of the armoured vehicle. (4) The platoon commander is mainly interested in giving instructions. (5) The platoon commander does not criticise work badly carried out. This latter behaviour only has a very slightly bad influence on effectiveness.

## 12 PSYCHOLOGICAL DEFENCE

### 121 Mass communication

(374) BN report 48

Egypt and Israel in the European élite press. A study of the "Structure of foreign news".

R. Cheesman

May 1970

Mr. Cheesman intends to investigate how the international news agency functions and which factors influence it. The investigated material consists of the treatment of the Middle East conflict by nine European, so called élite newspapers. He tests nine hypotheses, largely taken from Galtung and Ruge, on the structure of foreign news.

The following are examples of these hypotheses. The more remote a country is, the greater is the tendency to report actions carried out by élite people. The lower the standing of the named people, the more negative the tendency in judging the incident. The older the civilization, the more relevant must be the incident. The more a newspaper refers to another country, the more positive to that country the reporting becomes.

Of all the hypothesis only one is verified namely:- The proportion of analysed reported material from a country increases with a more positive attitude to that country. The author mentions that possible cause for the failure to verify the remaining eight hypotheses could be the coarse methods, inadequate samples and the fact that the hypotheses do not take into account factors which have a considerable significance for news media but which have no connections with the events themselves, for example the newspapers' political colour.